

Vision Based Camera Motion Tracking

Detailed Design

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Team 15

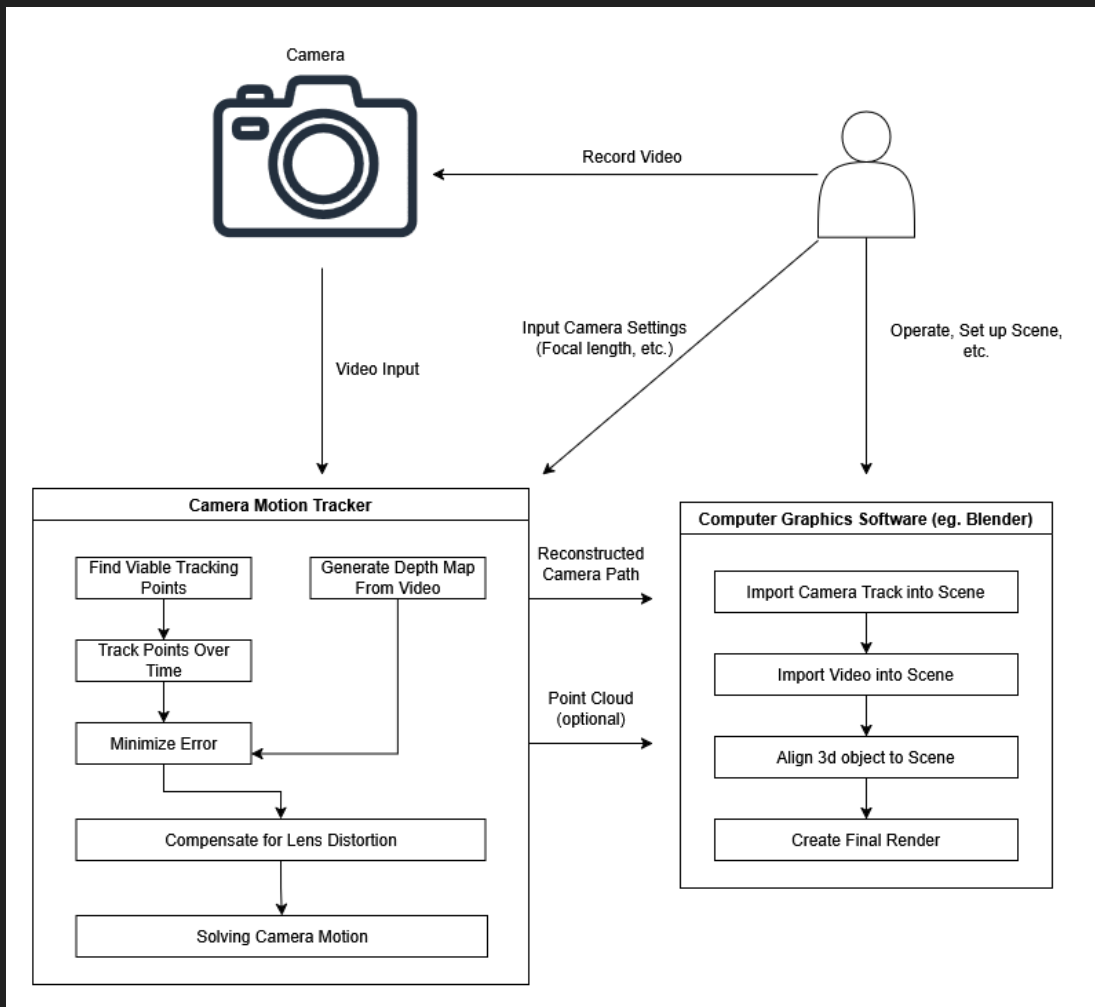
Background - Camera Tracking

- The visual effects industry is vast and constantly growing, and at the root of VFX is camera tracking.
- Available tools for camera tracking requires tedious manual labor and deeper knowledge of such software, which can be prohibitively expensive to beginners.
- Our product will significantly reduce the time required for the camera tracking step by combining it into one process. It will also be compatible and implemented within Blender, a free-to-use 3D modeling software.



Overview

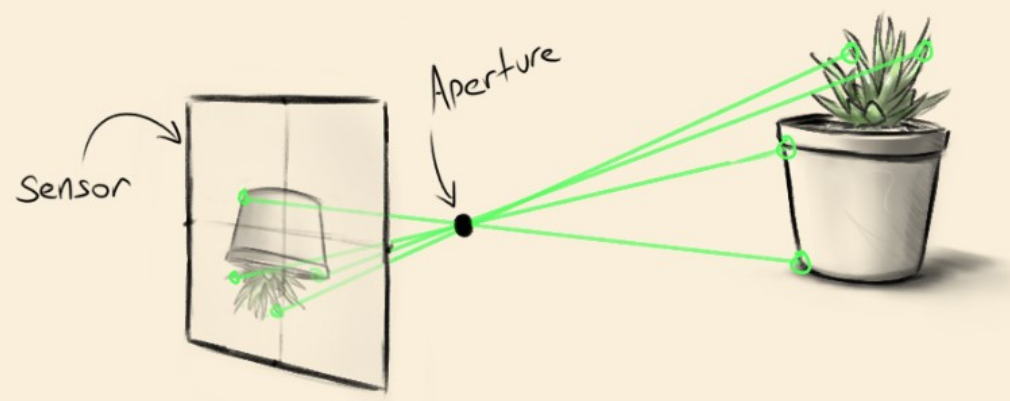
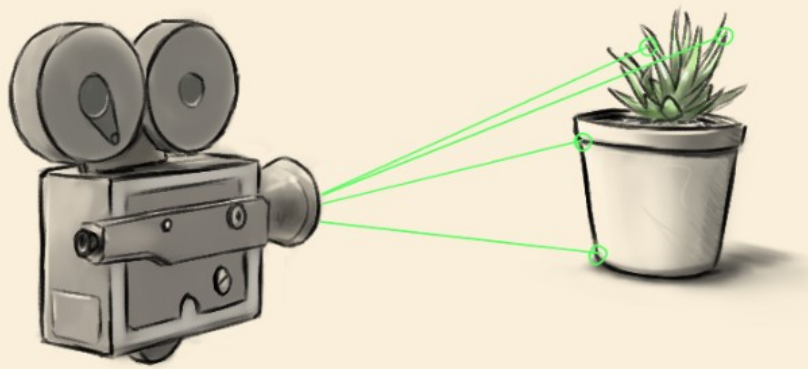
- A high level overview of our solution.
- Automation and fine control will appeal to casual and professional users respectively.

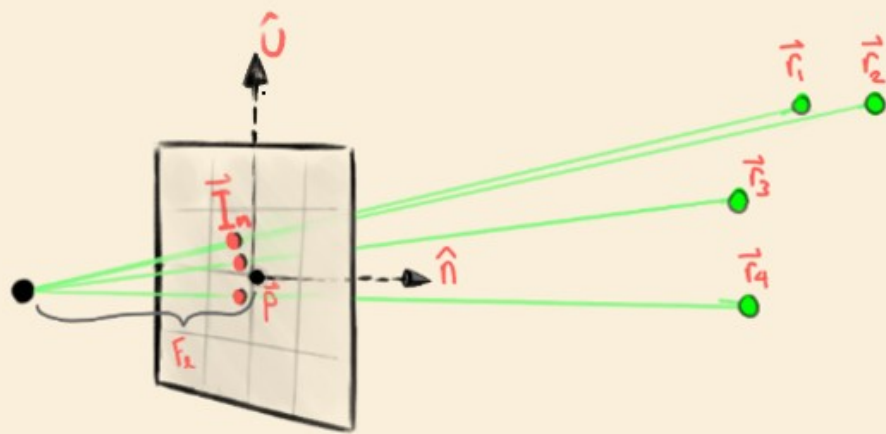


Finding Viable Tracking Points

- Identifies high-contrast points across different frames.
- These points are then tracked across frames to create paths usable by our camera motion-solving algorithm.
- Can produce errors, addressed later in the algorithm.







$$a = p - f_l \hat{n}$$

$$a + \hat{v} \lambda = p + c_1 \hat{m} + c_2 \hat{q}$$

$$-\hat{n} f_l = -\lambda \hat{v} + c_1 \hat{m} + c_2 \hat{q}$$

$$\hat{r} = \hat{n} \times \hat{u}$$

$$\begin{pmatrix} r_x & u_x & q_x \\ r_y & u_y & q_y \\ r_z & u_z & q_z \end{pmatrix} \begin{pmatrix} c_1 \\ c_2 \\ -\lambda \end{pmatrix} = -f_l \hat{n}$$

$$A v = -f_l \hat{n}$$

$$v = A^{-1}(-f_l \hat{n})$$

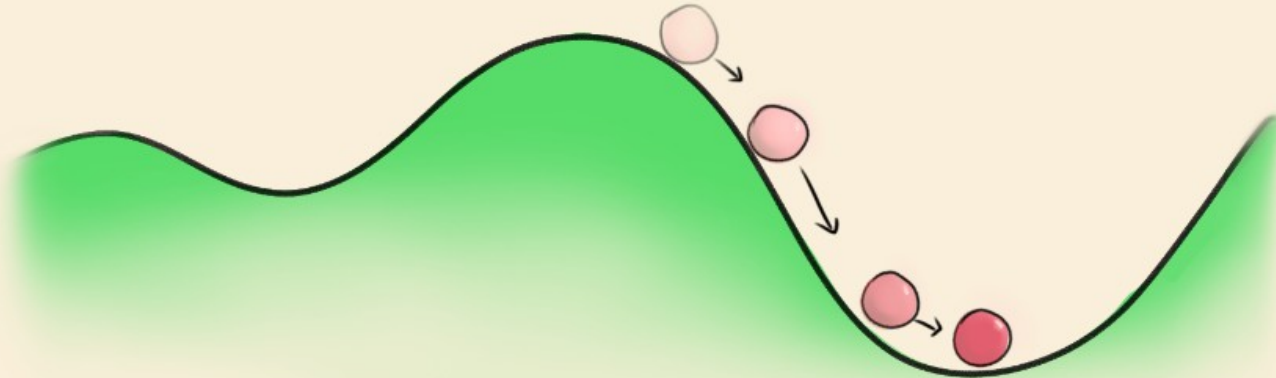
Gradient Descent

Pros

- Serendipitously solves for focal length and lense distortion

Cons

- Local Minimum
- Computationally taxing



Solving for:

Geometry

&

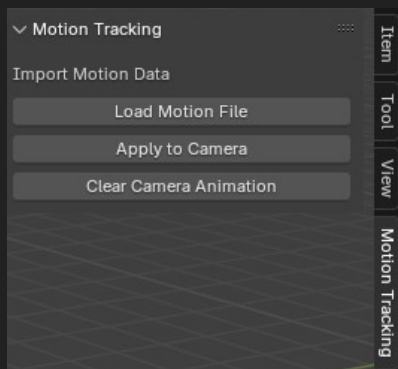
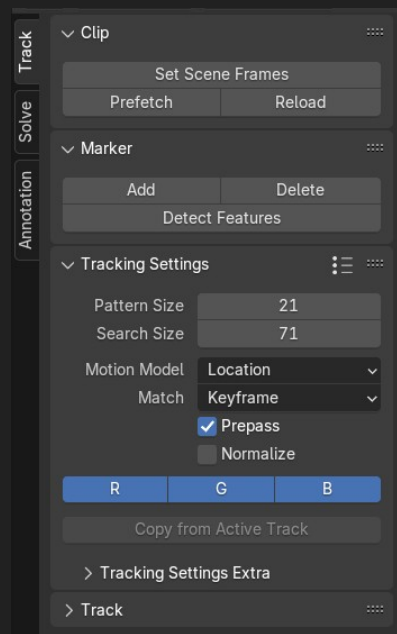
Motion



UI Blender Design

Blenders

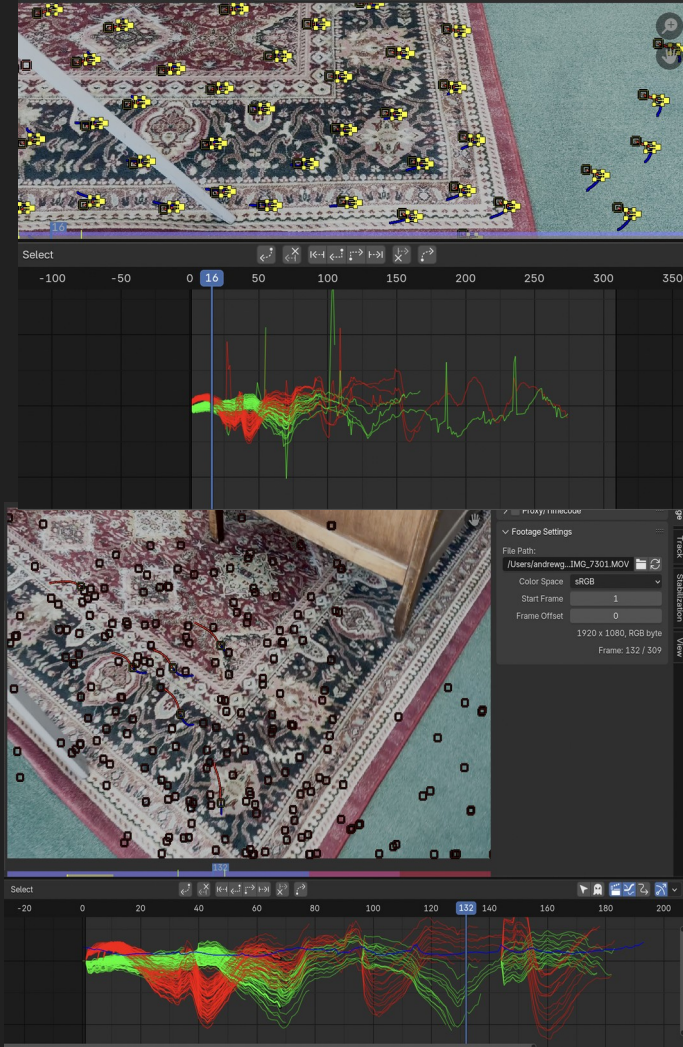
Ours



- Plugin within blender to work seamlessly with current workflows.
- Settings options for users and user correction
- Import and export at various steps(CSV, JSON, TXT)
- Our UI will be more extensive in camera tracking

Minimizing Errors

- Currently in Blender error detection is mostly manually done.
- Our goal is to make this process completely automated.
- Use scripts to automate the process of cleaning trackings



Questions